Project Introduction

Broadband fan noise -- closely tied to turbulent flow on and around the fan blades -- represents a key challenge to the noise reduction community due to the interaction of a highly turbulent flow field with complex, moving geometries. Prediction and high-fidelity simulation of fan noise demands a fundamental innovation in CFD methods due to moving geometries and accuracy requirements. The objective this work is to develop a flexible approach to handling multiple, overset grids for use in simulations of turbomachinery. In Phase 1 we will develop an innovative computational software tool for efficiently managing multiple, overlapping structured meshes in relative motion. This application will be used concurrently with a compressible Navier-Stokes solver and is an enabling technology in enabling high-fidelity simulations of turbulent flows in complex, moving geometries. Phase 1 will demonstrate software feasibility using a simplified model of the NASA Glenn Source Diagnostic Test (SDT) fan at realistic take-off conditions. We propose a simulation that includes a moving "rotor" blade row adjacent to a static blade row. Tailored post-processing of simulation results will provide information on the turbulent flow -- and implied turbulent noise sources -- including unsteady blade surface pressures, acoustic modes, and overall radiated noise. In Phase 2 we focus primarily on broadband turbulent noise sources of modern turbofan engines. By utilizing a realistic NASA SDT fan geometry and take-off flow conditions, we will use our new tools to simulate real-world systems and commercialize our software product.

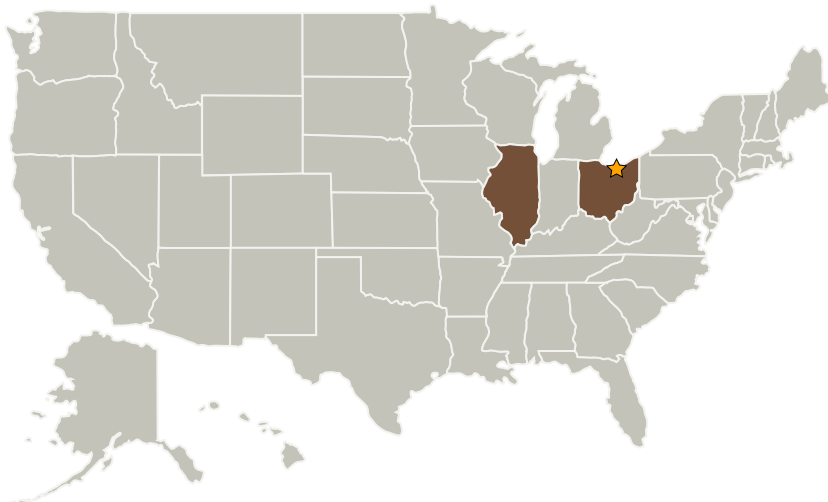## Primary U.S. Work Locations and Key Partners

High-Fidelity Simulation of Turbofan Noise, Phase I

Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
⭐Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
IllinoisRocstar, LLC	Supporting Organization	Industry	Champaign, Illinois

Primary U.S. Work Locations	
Illinois	Ohio

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  └ TX15.1 Aerosciences
    └ TX15.1.4 Aeroacoustics

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